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17. ABSTRACT (MAX. 250 WORDS)					
The principles of modern biology should be presented in a dynamic and challenging way to capable students to develop lasting interest in the subject and to place emphasis upon the role of the physical sciences in biology in accord with nationwide tendency. The course is complete in itself but provides a basis for students who elect advanced work. Objectives are to develop an appreciation of the differences of living organisms as well as their basic similarities, an awareness of the unity of science, a knowledge of the impact of environmental factors, a questioning attitude, and an analytical attitude of observation to develop insight. Units include the biology of cells (7 weeks), animals without backbones (7 weeks), activities of vertebrates (10 weeks), viruses and organisms without embryos (4 weeks), activities of embryo-forming plants (5 weeks), and continuity of life (2 weeks). Instructional aids are listed for each unit. References are given for some units. There are also general references.					
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CURRICULUM LABORATORY
WARWICK SCHOOL DEPARTMENT

BIOLOGY I
NEW APPROACHES
AND
OBJECTIVES

WARWICK, R.I.
PUBLIC SCHOOLS

NO. 2002

1960

WARWICK SCHOOL DEPARTMENT

WARWICK, RHODE ISLAND

Dr. Clarence S. Taylor
Superintendent of Schools

Horace E. Hobbs
Assistant Superintendent
Secondary Schools

Wilma I. Nagel
Assistant Superintendent
Elementary Schools

COMMITTEE ON
REVISION OF CURRICULUM FOR BIOLOGY I

Ann L. Lanoue, Coordinator of Advanced Classes
Joseph Rohloff, Chairman Science Department
Richard Hayes, Co-Chairman

Robert Coker
Robert Taylor

BIOLOGY I - ACCELERATED PROGRAM

Robert Coker - Richard Hayes - Robert Taylor

Suggested Text: Weisz, Paul B. Elements of Biology, c. 500 pp.
Price \$6.00. To be published before April 1, 1961, by
the McGraw-Hill Book Company.

Note: Moon, Otto, and Towle, Modern Biology, 1960 edition, to be used in
1960-61 only as basic text.

General References:

1. Weisz: The Science of Biology (McGraw-Hill)
2. Simpson et. al.: Life (Harcourt-Brace)
3. Marsland: Principles of Modern Biology, 3rd Ed. (Holt)
4. Mavor: General Biology (Macmillan)
5. Morholt et. al.: A Source Book for the Biological Sciences
(Harcourt-Brace)
6. Asimov: The Words of Science (Abelard Schuman)

Statement of Purpose:

This course proposes to present the principles of modern biology in a dynamic and challenging way to capable students, with the object of developing a lasting interest in the subject. Somewhat more emphasis will be placed upon the role of the physical sciences in biology than in the usual course, in accord with the nationwide tendency. This course will be complete within itself, but will also serve to provide a solid basis for students who elect advanced work in the biological sciences.

Objectives:

1. To develop an appreciation of the varieties of living organisms as well as their basic similarities.
2. To develop an awareness of the unity of science.
3. To develop an appreciation of the impact of environmental factors on the very existence of and the perpetuation of living organisms.

4. To create an attitude of questioning into the basic nature of biological events.
5. To create an attitude of analytical observation in order to develop insight.

I Key to Abbreviations:

- A. CBSC - Carolina Biological Supply Company
- B. Conn. - University of Connecticut
- C. EB - Encyclopedia Britannica
- D. Ill. - University of Illinois
- E. McGH - McGraw-Hill Book Company
- F. PS - Popular Science
- G. R. I. - Rhode Island Department of Education, Division of Audio-Visual Aids
- H. SVE - Society for Visual Education
- I. YA - Young America Filmstrips

UNIT I: THE BIOLOGY OF CELLS (7 weeks)

A. Introduction to biology

1. The scope
2. The methods
3. The values

B.. The nature of Life

1. Living compared with nonliving
2. The cell principle

C. Cell structure and function

1. Cell boundaries
 - a. Cell walls
 - b. Plasma membranesand absorption
2. Cytoplasm
 - a. Organelles
 1. Plastids and photosynthesis
 2. Mitochondria and respiration
 3. Ribosomes and protein synthesis
 4. Golgi apparatus and secretion (?)
 5. Centrosome and cell reproduction
 - b. Inclusions
 1. Vacuoles
 2. Granules, droplets, and globules
 - c. Ground substances and the endoplasmic reticulum
3. The nucleus
 - a. Chromosomes and cellular control
 - b. The nucleolus and information transfer
 - c. Ground substances
 - d. Nuclear division (mitosis)

D. Basic cellular chemistry

1. Principles of pure chemistry
 - a. Properties of atoms
 - b. Interaction of atoms
 - c. Organic vs. inorganic compounds
2. The chemistry and metabolism of carbohydrates
 - a. Nature of carbohydrates
 - b. Photosynthesis
 - c. Respiration of glucose
3. The chemistry and metabolism of lipids
 - a. Nature of lipids
 - b. Lipid metabolism

4. The chemistry and metabolism of proteins
 - a. Nature of proteins
 - b. Protein synthesis
5. The chemistry and metabolism of nucleic acids
 - a. Nature of nucleic acids
 - b. Template action

E. Unicellular organisms

1. Flagellates
2. Sarcodines
3. Ciliates
4. Parasitic Forms

INSTRUCTIONAL AIDS FOR UNIT I: THE BIOLOGY OF CELLS.

A. Scientific American Reprints.

1. #47. Wald: The Origin of Life
2. #27. Masia: Cell Division
3. #54. Rabinowitch: Photosynthesis
4. #61. Wald: Life and Light
5. #36. Siekevits: Powerhouse of the Cell
6. #41. Stumpf: ATP
7. #16. Green: The Metabolism of Fats
8. # 7. Doty: Proteins
9. #52. Zamecnik: The Microsome
10. # 5. Crick: Structure of the Hereditary Material
11. #54. Crick: Nucleic Acids
12. #60. Taylor: The Duplication of Chromosomes

B. Filmstrips.

1. Antony van Leeuwenhook (EB)
2. Kinds of Cells (FS)
3. What Are Elements and Compounds? (McGH)
4. Photosynthesis (FS)
5. What is Digestion? (FS)
6. Testing Foods and Nutrients (FS)

C. Motion Pictures.

1. Characteristics of Plants and Animals (RI)
2. The Cell: Structural Unit of Life (RI)
3. Cell Division (RI)
4. Carbon - 14 (RI)

D. Microscope Slide

1. Allium root tip, mitosis (CBSC)

E. Charts and Models

1. Charts of cells and tissues
2. Model of stages in mitosis

F. Laboratory Work and Microscope

1. Examination of Pond Life
2. Onion leaf epidermis, Elodea leaf
3. Plant and Animal Cells.
4. Qualitative Analysis of Nutrients

G. References.

1. McElroy: Cellular Physiology and Biochemistry (Prentice-Hall)
2. Potter: Nucloic Acid Outlines: Volume I (Burgess)
3. Swanson: The Cell (Prentice-Hall)
4. Swanson: Cytology and Cytogenetics (Prentice-Hall)
5. Villee: Biology (W. B. Saunders)
6. Weisz: The Science of Biology (McGraw-Hill)
7. Asimov: The Chemicals of Life (Abelard-Schuman)
8. A Short Course in Organic Chemistry (Houghton-Mifflin)
9. Peterson and Strong: General Biochemistry (Prentice-Hall)
10. Jahn: How to Know the Protozoa (Wm. C. Brown)
11. The Physics and Chemistry of Life: A Sci. Am. Book (Simon & Schuster)

UNIT II: ANIMALS WITHOUT BACKBONES (7 weeks)

A. Classifications

1. Importance
2. Method
3. General taxonomic categories

B. Coelenterates

1. Colonization
2. Polymorphism
3. Cell specialization
4. Regeneration

C. Flatworms

1. Planarians
2. Flukes
3. Tapeworms

D. Rotifers

1. Life cycle
2. Development

E. Annelids

1. Earthworm
 - a. Metabolic systems
 - b. Reproduction
2. Clamworm and leech for comparison

F. Arthropods

1. Crustacea
 - a. Macrocrustacea
 - b. Microcrustacea
2. Arachnids
3. Insects
 - a. Metabolic systems
 - b. Life cycles
 - c. Use in genetics (e. g., fruit fly)
 - d. Social insects
 - e. Economic importance

G. Mollusks

1. Variety
2. Economic importance

H.. Echinoderms

1. Variety
2. Embryology

INSTRUCTIONAL AIDS FOR UNIT II: ANIMALS WITHOUT BACKBONES

A. Scientific American Reprints

1. #49. Williams: The Metamorphosis of Insects.
2. #63. Wigglesworth: Metamorphosis and Differentiation
3. #21. Krogh: Language of the Bees
4. #43. Tyler: Fertilization and Antibodies
5. #45. Waddington: How do Cells Differentiate?
6. #56. Ebert: The First Heartbeats

B. Filmstrips

1. Carolus Linnaeus (EB)
2. Roll Call of the Animals (McGH)
3. Protozoans (McGH)
4. Sponges and Coelenterates (McGH)
5. Flatworms (McGH)
6. Roundworms (McGH)
7. Segmented Worms (McGH)
8. Crustaceans (McGH)
9. Small Creatures of the Desert (EB)
10. Class Insecta (McGH)
11. Mollusks (McGH)
12. Echinoderms (McGH)

C. Motion Pictures

1. Protozoa (Conn)
2. Life in a Drop of Water (Ill)
3. Australia's Coral Wonderland (Ill)
4. Crustaceans: Lobsters, Barracles, Shrimp, and Their Relatives (Conn)
5. The Earthworm (RI)
6. "Worms" to Wings (RI)
7. The Rival World (Conn)
8. Mollusks (Indiana University)
9. Sea Urchin (Ill)

D. Charts and Models

1. Set of Charts on Animals
2. Bottled specimens of animals
3. Earthworm model
4. Crayfish model
5. Grasshopper model
6. Caterpillar model

E. Laboratory Work

1. Observation of Living Protozoa
2. Observation of Coelenterates

3. Observation of Flatworms
4. Observation and Dissection of the Earthworm
5. Observation and Dissection of the Crayfish
6. Observation of Microcrustacea
7. Observation of the Grasshopper
8. Embryonic Stages of the Starfish

F. References

1. Buchsbaum: Animals Without Backbones (University of Chicago)
2. Miller and Haub: General Zoology (Holt)
3. Winchester: Zoology (Van Nostrand)
4. Elliott: Zoology (Appleton Century Crofts)
5. Storer and Usinger: General Zoology, 3rd Ed. (McGraw-Hill)
6. Burnett, Fisher, and Zim: Zoology (Simon and Schuster)
7. Zim and Ingle: Seashores (Simon and Schuster)
8. Miner: Field Book of Seashore Life (G. P. Putnam's Sons)
9. Morgan: Field Book of Ponds and Streams (G. P. Putnam's Sons)
10. Hanson: Animal Diversity (Prentice-Hall)
11. Sussman: Animal Growth and Development (Prentice-Hall)
12. Chu: How to Know the Immature Insects (Wm. C. Brown)
13. Jaques: How to Know the Insects (Wm. C. Brown)

UNIT III: THE ACTIVITIES OF VERTEBRATES (10 weeks)

A. Reproduction

1. Trends in evolution (egglayers, livebearers, care of young)
2. Amphibian metamorphosis and the transition to land
3. Mammalian reproduction

B. Skeletal and muscular organization

1. Bone formation
2. Muscle physiology

C. Alimentation

1. Mechanical features of digestion
2. Nature and action of enzymes
3. Results of digestion
4. Absorption and egestion
5. Uses of foods within the body

D. Circulation

1. Blood
2. Hearts (2-, 3-, and 4- chambered)
3. Blood vessels and circulation of blood
4. Lymphatic system and spleen

E. Breathing and Respiration

1. Breathing (gills, lungs, mechanics, gaseous transport)
2. Respiration (within cells; role of oxygen; ATP formation)
3. Calorimetry of foods

F. Protein Metabolism and Excretion

1. Protein synthesis
2. Liver and deamination
3. Kidneys, skin, and lungs

G. Regulation and Behavior

1. Endocrinology
2. Nerves and reflex action
3. The vertebrate brain
4. The organs of special sense (eyes, ears, skin, tongue, nose)

INSTRUCTIONAL AIDS FOR UNIT III: THE PHYSIOLOGY OF VERTEBRATES

A. Scientific American Reprints

1. #19. Husley: The Contraction of Muscle
2. #15. Green: Enzymes in Teams
3. #62. Wiggers: The Heart
4. #64. Zweifach: The Microcirculation of the Blood
5. #23. Linderstrom-Lang: How is a Protein Made?
6. #37. Smith: The Kidney
7. #13. Gray: The Great Unravelling Knot
8. #58. Keynes: The Nerve Impulse and the Squid
9. #44. Bekesy: The Ear
10. #46. Wald: Eye and Camera

B. Filmstrips

1. Reproduction Among Mammals (EB)
2. Posture and Exercise (EB)
3. The Teeth (EB)
4. The Digestive System (SVE)
5. What is Digestion (FS)
6. Foods and Nutrition (EB)
7. How Vitamins Help Man (McGH)
8. William Harvey (EB)
9. Heart and Circulation (EB)
10. Work of the Blood (FS)
11. Mechanisms of Breathing (EB)
12. Work of the Kidneys (EB)
13. The Glandular System (SVE)
14. The Endocrine Glands (EB)
15. How Hormones Control the Body (McGH)
16. The Nervous System (EB) (McGH)
17. What is Behavior? (McGH)
18. Control of Body Temperature (EB)
19. The Eyes and their Care (EB)
20. The Eyes and Hearing (EB)

C. Motion Pictures

1. Life Cycle of Trout (RI)
2. Fish Out of Water (Conn)
3. Life Cycle of the Frog (RI)
4. Reproduction Among Mammals (RI)
5. Digestion of Foods (RI)
6. Hemo, the Magnificent (Bell Tel. Co.)
7. Understanding Your Emotions (RI)
8. The Human Machine (Ill)

D. Microscope Slides (CBSC)

1. Testis, epididymis, mature
2. Ovary, Graafian follicle, mammal
3. Bone, ground, human
4. White fibrous tissue
5. Elastic cartilage, mammal
6. Adipose tissue, mammal
7. Muscle types
8. Foliate papillae, rabbit
9. Ciliated epithelium, macerated
10. Duodenum, mammal
11. Endothelium, silver
12. Artery and vein, mammal
13. Lung, mammal
14. Spinal cord, mammal, silver
15. Nissl bodies
16. Skin, mammal
17. Simple squamous epithelium

E. Charts and Models

1. Model of frog
2. Human Torso
3. Human skeleton
4. Heart model
5. Kidney model (nephric unit)
6. Brain model
7. Skin model
8. Eye model
9. Ear model
10. Various charts

F. References

1. Romer: The Vertebrate Body (W. B. Saunders)
2. Best and Taylor: The Human Body (Holt)
3. Best and Taylor: The Living Body (Holt)
4. Morrison, Cornett, and Tether: Human Physiology (Holt)
5. Miller and Haub: General Zoology (Holt)
6. Guthrie & Anderson: General Zoology (Wiley)
7. Villee: Biology (W. B. Saunders)
8. Borek: Man, The Chemical Machines (Columbia Univ. Press)
9. Mavor: General Biology (Macmillan)
10. Houssay: Human Physiology, 2nd edition (McGraw-Hill)
11. Eddy: How to Know the Fresh Water Fishes (Wm. C. Brown)

UNIT IV: VIRUSES AND ORGANISMS WITHOUT EMBRYOS (4 weeks)

A. Monera

1. Blue-green algae
2. Bacteria
 - a. Cell structure
 - b. Metabolism
 - c. Economic importance
 - d. Pathology
 - e. Bacterial genetics

B. Viruses

1. Structure
2. Pathology

C. Fungi

1. Yeasts
2. Molds
 - a. Morphology
 - b. Reproduction and life cycles
 - c. Use in biochemical genetics (e. g., *Neurospora*)
 - d. Antibiotics
3. Rusts and smuts

D. Algae

1. Green
 - a. Flagellates
 - b. Filamentous forms
 1. Isogamy
 2. Heterogamy
 - c. Desmids
2. Diatoms
 - a. Cell structure
 - b. Economic importance (esp. food chains)
3. Seaweeds
 - a. Morphology
 - b. Life cycles

INSTRUCTIONAL AIDS FOR UNIT IV: VIRUSES AND ORGANISMS WITHOUT EMBRYOS

A. Scientific American Reprints

1. # 9. Frankel-Conrat: Rebuilding a Virus
2. #50. Woolmann and Jaecb: Sexuality in Bacteria
3. #18. Hotchkiss and Weiss: Transformed Bacteria
4. #24. Luria: The T2 Mystery
5. # 1. Beadle: The Genes of Men and Molds

B. Filmstrips and Kodachromes

1. Louis Pasteur (EB)
2. How Plants Grow and Reproduce (SVE)
3. Kodachromes (Scientific Supplies Co., 600 Spokane Street, Seattle 4, Washington)

C. Motion Pictures

1. Bacteria: Friend and Foe (Conn)
2. Life of the Molds (RI)
3. World of Little Things (Conn)
4. Reproduction in Plants (Ill)

D. Charts and Models

1. Sets of charts on plants
2. Single charts

E. Laboratory Work

1. Culturing and Identifying Bacteria
2. Observation of Yeasts and Molds
3. Observation of Algae

F. References

1. Frobisher: Microbiology (W. B. Saunders)
2. Fuller: The Plant World (Holt)
3. Wilson: Botany (Dryden Press)
4. Prescott: How to Know the Fresh-Water Algae (Wm. C. Brown Co.)
5. Northen: Introductory Plant Science (Ronald Press)
6. Stannier et. al.: Microbial World (Prentice-Hall)
7. Dawson: How to Know the Seaweeds (Brown)

UNIT V: THE ACTIVITIES OF EMBRYO-FORMING PLANTS (5 weeks)

A. Bryophytes

1. Morphology
2. Life cycles
3. Plant succession
4. Economic importance

B. Tracheophytes

1. Taxonomy
2. Trends in reproduction
3. Structure and function
 - a. Roots and absorption
 - b. Stems and conduction
 - c. Leaves and food-making
 - d. Flowers and reproduction
 - 1) Meiosis
 - 2) Embryology
 - 3) Cell Differentiation

INSTRUCTIONAL AIDS FOR UNIT V: THE ACTIVITIES OF EMBRYO-FORMING PLANTS

A. Scientific American Reprints

1. #53. Biddulph: The Circulatory System of Plants
2. #61. Wald: Life and Light
3. #12. Grant: The Fertilization of Flowers

B. Filmstrips and Kodachromes

1. The Structure of Flower Plants (SVE)
2. Kodachromes

C. Motion Pictures

1. Roots of Plants (RI)
2. Carnivorous Plants (RI)
3. Plant Life at Work (I11)
4. Plant Growth (RI)

D. Microscope Slides (CBSC)

1. Botrychium: root, stem, and stipe
2. Root tip
3. Ranunculus root
4. Pine root
5. Tilia Americana root
6. Ricinus stem tip, median
7. Monocot and dicot stems
8. Zea mays stem
9. Cucurbita stem
10. Tilia three-year old stem
11. Magnolia stem
12. Pinus strobus bark
13. Liriodendron tulipifera
14. Pinus australis
15. Syringa leaf bud
16. Pine, 5-needle
17. Lily anthers-mature pollen
18. Lilium style and stigma
19. Diospyros endosperm
20. Capsella-mature embryo
21. Lilium ovary: 8-nucleate stage

E. Charts and Models

1. Sets of charts on plants
2. Single charts

F. Laboratory Work

1. Roots and absorption
2. Stems and conduction
3. Leaves and food-making
4. Flower structure

G. References

1. Esau: Plant Anatomy (Wiley)
2. Foster: Practical Plant Anatomy (Van Nostrand)
3. Wilson: Botany (Dryden Press)
4. Northen: Introductory Plant Science (Ronald)
5. Mavor: General Biology (Macmillan)
6. Villee: Biology (W. B. Saunders)
7. Bonner & Galston: Principles of Plant Physiology (W. H. Freeman)
8. Conard: How to Know the Mosses (Wm. C. Brown)
9. Taylor & Weber: General Botony (Van Nostrand)
10. Mayer & Anderson: Plant Physiology (Van Nostrand)

UNIT VI: THE CONTINUITY OF LIFE (2 weeks)

A. Genetics

1. Mendel's laws
2. Population genetics
3. Causes of variation

B. Ecology

1. Physical factors of environment
2. Biological factors of environment

C. Organic change

INSTRUCTIONAL AIDS FOR UNIT VI: THE CONTINUITY OF LIFE

A. Scientific American Reprints

1. #17. Horowitz: The Gene
2. #39. Sonneborn: Partner of the Genes
3. #60. Taylor: The Duplication of Chromosomes
4. #47. Wald: The Origin of Life
5. # 6. Dobzhansky: The Genetic Basis of Evolution
6. #29. Muller: Radiation and Human Mutation.

B. Filmstrips and Kodachromes

1. Gregory Mendel (EB)
2. Heredity (EB) (McGH)
3. Environment (YA)
4. Origin of Life (YA)
5. Interdependence of Life (YA)
6. Heredity and Environment (YA)
7. Charles Darwin (EB)
8. Survival (YA)
9. Kodachromes on heredity

C. Motion Pictures

1. Mitosis and Meiosis (Ill)
2. Basic Nature of Sexual Reproduction (Ill)
3. Chain of Life (Ill)
4. Seashore Life (Conn)

D. Microscope Slides (CBSC)

1. Salivary chromosomes of fruit fly
2. Monohybrid crosses, lateral

E. Charts and Models

1. Chart in botany set

F. Laboratory Work

1. Probability

G. References

1. Srb and Owen: General Genetics (W. H. Freeman)
2. Sinnott, Dunn, and Dobzhansky: Principles of Genetics (McGraw-Hill)
3. Snyder and David: Principles of Heredity (Heath)
4. Odum: Fundamentals of Ecology (W. B. Saunders)
5. Oparin: Origin of Life (Dover)
6. Stover: The Web of Life (Devin-Adair)
7. Gaull: The Wonderful World of the Seashore (Appleton-Century-Cross)
8. Donner: Cells & Societies (Princeton Univ.)

I Principles from physical sciences:

- A. Light and vision
- B. Sound and hearing
- C. Heat and calorimetry
- D. Mechanical Advantage and Muscle Action
- E. The Gas Laws and Breathing
- F. Electricity and Nerve Impulses
- G. Atomic Physics and Radioisotopes
- H. Molecular Physics and Diffusion
- I. Chemical Reactions in the Living Cell
- J. Carbon and its Components